Conclusions: Low dose radiotherapy provides effect palliation of distressing symptoms resulting from cutaneous KS with acceptable toxicity.

165
A PRACTICAL ENERGY MODULATION TECHNIQUE TO AVOID ENUCLEATION FOR ADVANCED PERIOCULAR CANCERS
Jon-Paul Voroney, Alana Hudson, Yannick Poirier, David Spencer, Ferenc Jacso, Kevin Martell
Tom Baker Cancer Centre and University of Calgary, Calgary, AB

Purpose: Consider a 2x2x1.5 cm basal cell cancer invading right medial canthus periocular embryonic fusion plane. Usual techniques fail: an irregular PTV 4x4x2.5 cm deep, a concave surface, a deep tumour, and adjacent ocular structures. Oculoplastics/Mohs risk enucleation. Electrons with an internal eye shield require bolus and limit energy to 9 MeV. High energy conformal RT risks medial retinal damage. Systemic agents may palliate but do not cure. We describe low energy electron RT (e-) with an orthovoltage (ortho) bump. "Bump" modulates energy by replacing some e-dose with ortho to increase surface dose and optimize dose distribution. Bump applies to any anatomic location to a depth of 2-3 cm. Bump can use e- with a tungsten eye shield and ortho for maximal eye-sparing. With orbit invaded, morbidity follows. Radiotherapy may be the best eye-preserving option.
Methods and Materials: Central-axis dose calculation using measured % depth dose were compared with central and off-central axis dose calcs using kVDoseCalc, a dose engine validated in kV cone-beam and ortho therapy; and Monte Carlo for e- off-axis dose calc. We compare conformal RT, arcs, and bump, for periocular cancer cases. We compared central axis data for a 4x4 cm field with: 1) 9 MeV alone; 2) 9 MeV with 0.7 cm custom wax; 3) 9 MeV, 80% of dose, 100 kV DXR bump, SSD 10 cm, 20% of dose; 4) 9 MeV, 80% of dose, 200 kV DXR bump, SSD 50 cm, 20% of dose. Patients treated at our institution in 10 or 20 treatments received 8 or 16 electron treatments (prescribed to account for REB of electrons) and 2 or 4 photons treatments, for a total dose of 45 Gy in 10 fractions, or 50 Gy in 20 fractions.
Results: For the case above tables based on measured dose give: Surface dose (1) 86%; (2) 90%; (3) 100%; (4) 94% Dmax (100%) (1) 2.0 cm; (2) 1.3 cm; (3) 2.0 cm; (4) 2.0 cm Dose @ 2.7 cm (1) 89%; (2) 58%; (3) 87%; (4) 91% Surface and depth refer to skin surface. Dose is normalized: Dmax = 100%. REB and geometry are not included. Comparing dynamic conformal ARCs, VMAT, electrons +/- bolus or tantalum mesh, and bump show the benefits of 9 MeV with 100-200 kV bump. Dose drop off is swift at ~40%/cm beyond D90%. Dose spares eye. Low SSD, low kV bump results in best homogeneity and surface dose; high kV bump gives best dose at depth. Patients can be scanned with a 3D printer wax replica eye shield to reduce artifact and enable accurate dose calculation. Actual patient results are illustrated with isodose distributions; for three clinical cases, the dose above 80% to retina was 2.5 cc for conformal treatment, 1.0 cc for dynamic conformal arc and < 0.5 cc for bumps, demonstrating excellent shielding for the bump technique.
Conclusions: Energy modulation with ortho and electrons can result in improved dose distribution. Benefits include: increased treatment depth, improved dose homogeneity, no bolus, increased shield effectiveness, and reduced penumbra; important when treating near the eye.

166
IN VIVO MEASUREMENT OF CEST MRI SIGNAL IN MURINE XENOGRAFTS
Jonathan Klein, Gregory Czarnota, Wilfred Lam, Christine Tarapacki, Gregory Stanisz
University of Toronto, Toronto, ON

Purpose: Chemical exchange saturation transfer magnetic resonance imaging (CEST MRI) represents a novel technique for detecting cell death in vivo, without the need for injected exogenous contrast media or lengthy wait times (as with standard anatomical assessment of tumour response). Changes in CEST signal parameters corresponding to amide, amine, and aliphatic tissues have been suggested to correlate with necrosis. In this study, we sought to characterize the changes in CEST parameters over time to help determine the optimal time point to detect cell death.
Methods and Materials: CEST MRI data were acquired from xenografted MDA-231 breast cancer tumours (n = 12) before and after injection with doxorubicin (100 mg/m2) and paclitaxel (50 mg/m2) chemotherapy. Tumours were scanned at baseline and three different treatment times - 4, 8, and 12 hours after injection.
Acquired data was fitted to Lorentzian shapes using a previously described method. The peak amplitude is measured as a unitless ratio of the measured signal to the CEST signal of bulk water; area under the curve is in units of parts per million (ppm), related to the resonant frequency of measured protons. Baseline CEST parameters were compared to parameters at each treatment time using two-tailed T tests with p-value for significance of ≤ 0.05.
Results: For the aliphatic peak, amplitude measured 0.063 ± 0.009 at baseline, 0.066 ± 0.009 at four hours, 0.095 ± 0.013 at 8 hours, and 0.065 ± 0.019 at 12 hours post-injection; only the change from baseline to eight hours was statistically significant ($p = 0.02$). Significant change in area under the curve (0.051 ± 0.014 to 0.115 ± 0.015 ppm; $p = 0.006$) was also observed at eight hours post-injection but not at four or 12 hours. For the amine peak, significant changes in amplitude were observed at eight hours ($p < 0.001$) and 12 hours ($p < 0.001$) post-injection; amplitude change was not significant at four hours nor was any change in peak area at any time point. For the amide peak, no significant differences were seen from baseline at any time point for peak amplitude or area.
Conclusions: Our results suggest that eight hours after injection of chemotherapy may represent the optimal time to measure cell death using CEST MRI, as significant changes were observed in aliphatic and amine peak amplitudes at this time point.

167
MEASUREMENT OF TUMOUR HYPOXIA IN PATIENTS WITH LOCALLY ADVANCED NON-SMALL CELL LUNG CANCER (NSCLC) USING POSITRON EMISSION TOMOGRAPHY (PET) WITH 18F-FLUOROAZOMYCIN ARABINOSIDE (18F-FAZA)
Angela Lin[1], Douglaas Vines[2], Brandon Driscoll[2], Lisa W. Le[2], Stephen Breen[2], Alexander Sun[2]
[1]Princess Margaret Cancer Centre, Toronto, ON
[2]University of Toronto, Toronto, ON

Purpose: Tumour hypoxia is an adverse prognostic factor in many cancers. 18F-FAZA is a hypoxia tracer, which can provide a non-invasive method of hypoxia imaging with PET, but has not been widely studied in NSCLC. This study aims to evaluate the feasibility and potential benefits of using 18F-FAZA-PET scans to assess NSCLC tumour hypoxia.
Methods and Materials: Thirteen of the planned 20 patients with Stage II – III NSCLC are included thus far in this prospective study by imaging with FAZA-PET before initiation of radical chemo-radiotherapy. Patients were imaged two hours post-injection with FAZA. Attenuation correction was performed using a helical computed tomography (hCT) for respiratory gated PET (gPET). The exhale bin was used for analysis for the purpose of this study. The hypoxic volume (HV) was defined as all voxels within the tumour with standard uptake value (SUV) more than three standard deviations from the mean values obtained from muscle SUV as defined by Mortensen et al. 2012. The Tmax/Mmean ratio was defined as maximum tumour SUV divided by the mean erector spinae muscle SUV. The hypoxic fraction (HF) was determined by dividing the HV by the entire gross tumour volume (GTV). Pearson correlation (rho) was performed to evaluate whether some of these metrics are correlated.
Results: A hypoxic volume (HV) in the primary tumour was identified in 12 patients (92.3%). The hypoxic fraction (HF)